

Chapter 3:

Profile of the MP&M Industries

INTRODUCTION

The proposed MP&M rule would apply to facilities that manufacture, rebuild, or maintain metal parts, products or machines to be used in a large number of industrial sectors. **Manufacturing** is the series of unit operations necessary to produce metal products, and is generally performed in a production environment. **Rebuilding/maintenance** is the series of unit operations necessary to disassemble used metal products into components, replace the components or subassemblies or restore them to original function, and reassemble the metal product. These operations are intended to keep metal products in operating condition and can be performed in either a production or a non-production environment. Manufacturing and rebuilding/maintenance activities often occur at the same facilities.

The MP&M industry encompasses a large number of industries that manufacture intermediate and final goods, support transportation and other vehicle services, and repair and maintain products and equipment. The health of the MP&M industries is generally tied to the overall economic performance of the economy. The MP&M industry includes manufacturing and non-manufacturing industries defined by 224 4-digit **Standard Industrial Classification (SIC)** codes, which are grouped into nineteen sectors.¹ Of the 224 SIC codes, 174 are manufacturing (SICs 20 through 39) and 50 are non-manufacturing. All nineteen sectors include manufacturing industries, and eleven include non-manufacturing industries as well.

This chapter provides a profile of the sectors potentially affected by the proposed MP&M rule. The profile focuses on the economic characteristics of these sectors, and the regulated facilities within these sectors, which may affect the financial and economic impacts of the proposed rule.

3.1 DATA SOURCES

This profile presents data from the *Economic Censuses*, *Statistics of U.S. Businesses* (SUSB), and *Annual Survey of*

¹ Appendix A lists the nineteen sectors and their associated 4-digit SIC codes.

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Manufactures (ASM), the *U.S. Industry and Trade Outlook*, EPA's Sector Notebooks, and other sources, to characterize the MP&M sectors as a whole, including both dischargers and non-dischargers.

This profile relies on industries defined by SICs, both because data collection for the MP&M sectors was defined by SICs and to allow for use of historical data. The Census Bureau switched to use of the new North American Industry Classification System (NAICS) codes starting with the 1997 Economic Censuses. Lack of a one-to-one correspondence between an SIC and a NAICS code prevented the Agency

from matching the 1997 to earlier years' data for a number of sectors. This profile therefore relies primarily on the 1992 Censuses and, for manufacturing sectors, the 1996 Annual Survey of Manufactures.

The Agency used survey data to characterize the facilities within the MP&M sectors that are potentially subject to the proposed rule because they discharge process wastewater from MP&M operations. The survey provides data such as discharge type, small business status, sources of revenues, and financial performance.

The survey requested information on the sectors from which each facility derives its revenues. Many facilities derive revenues from more than one sector. It is therefore difficult

to link facility characteristics to a specific sector. Data on the potentially-regulated facilities are therefore summarized by the proposed regulatory subcategories rather than by sectors.

3.2 OVERVIEW OF THE MP&M INDUSTRY AND INDUSTRY TRENDS

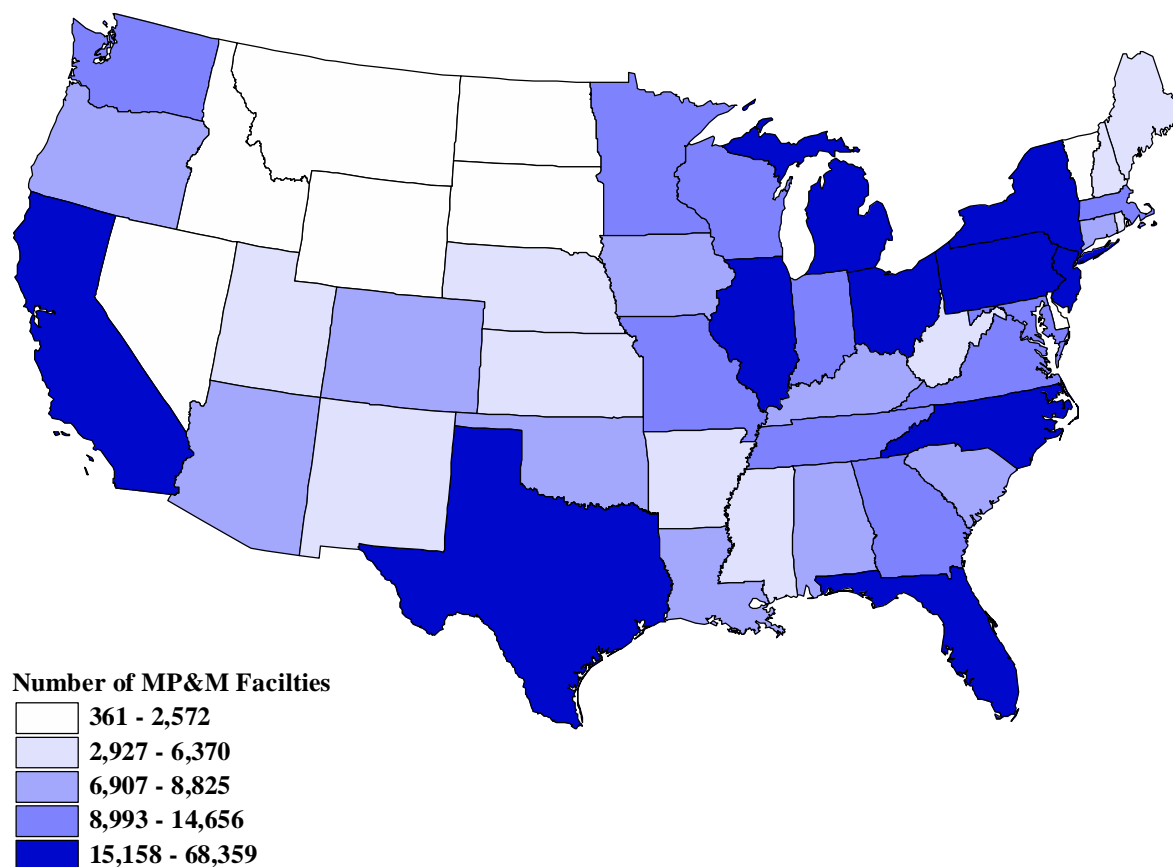
Table 3.1 lists the MP&M sectors and provides a brief description of the products and services produced by each. Appendix A provides a more detailed list of the 4-digit SIC codes in each sector.

Table 3.1: MP&M Sector Definitions

Sector	Sector Description
Aerospace	Metal parts or products such as missiles, space vehicles, satellites and associated launching equipment.
Aircraft	Metal parts or products including all types of aircraft for public, private or commercial use. Includes aircraft parts and equipment as well as aircraft maintenance activities.
Bus and Truck	Metal parts or products including freight trucks and trailers as well as public, private and commercial buses. Includes all associated equipment including equipment specific to truck and bus terminals. Includes bus and truck maintenance activities.
Electronic Equipment	Metal parts or products including general electronic components such as tubes, capacitors, and transformers, as well as finished electronic equipment such as television, radio, and telephone.
Hardware	Metal parts or products such as tools, cutlery, valves and tubing, dies, springs, sheet metal, drums, and heat treating equipment.
Household Equipment	Metal parts or products including appliances such as refrigerators, laundry equipment, lighting equipment, cooking equipment, and vacuum cleaners. Non-communication type radios and televisions are included in this sector.
Iron and Steel	Sites engaged in iron or steel manufacturing, forming and finishing.
Instruments	Metal parts or products such as laboratory and medical equipment, measuring devices, environmental and process controls, optical equipment, surgical and dental equipment, and pens.
Metal Finishing Job Shop	Facilities with more than 50 percent of their revenues coming from work on products not owned by the site. While there are SIC codes associated with some Metal Finishing Job Shops, they sell to a variety of markets and are not a market in and of themselves.
Mobile Industrial Equipment	Metal parts or products including tractors and other farm equipment, construction machinery and equipment, mining machinery and equipment, industrial cranes and hoists, and tracked military vehicles.
Motor Vehicle	Metal parts or products including private passenger vehicles and associated parts and accessories such as automobiles, motorcycles, utility trailers and recreational vehicles, and mobile homes.
Office Machines	Metal parts or products including office computer equipment, storage devices, printers, photocopiers and associated parts and accessories.
Ordnance	Metal parts or products including all small arms, artillery, and ammunition with the exception of missiles (aerospace). Does not include the chemical processing or the manufacture of explosives.
Other Metal Products	Metal parts or products including products and machinery not categorized into the other sectors (e.g., sporting goods, musical instruments).
Precious Metals and Jewelry	Metal parts or products including jewelry, silverware, trophies, and clocks as well as all associated parts and accessories.
Printed Wiring Boards	Metal parts or products including printed wiring boards and printed wiring boards.
Railroad	Metal parts or products including railcars, locomotives and associated parts and accessories as well as track, switching and terminal stations.
Ships and Boats	Metal parts or products including ships and boats for military, freight, and private recreation. Includes submarines, ferries, tug boats, barges, yachts, and other recreational boats as well as all parts and accessories. Also includes rebuilding and maintenance activities performed at marinas, dry docks, and other on shore activities specifically related to ships and boats.
Stationary Industrial Equipment	Metal parts or products including all industrial machinery, such as turbines, oil field machinery, elevators and moving stairways, conveying equipment, chemical process industry equipment, pumps, compressors, blowers, industrial ovens, vending machines, commercial laundry equipment, commercial refrigeration and heating equipment, welding apparatus, motors, and generators.

Figure 3.1 shows that there MP&M facilities are located in every state. A few MP&M sectors such as shipbuilding are concentrated geographically, and transportation-related MP&M facilities are found throughout the country. Overall,

however, MP&M facilities are most concentrated in the heavy industrial regions along the Gulf Coast, both East and West Coasts, and the Great Lakes Region (New York, Pennsylvania, Ohio, Indiana, Illinois, and Michigan).

Figure 3.1: Number of MP&M Facilities by State

Source: Department of Commerce, Bureau of the Census, Census of Manufactures, Census of Transportation, Census of Wholesale Trade, Census of Retail Trade, Census of Service Industries, 1992.

Table 3.2 shows output by sector for manufactures, non-manufactures, and sector total. In 1992, MP&M facilities accounted for more than \$1.9 trillion in output. Manufacturing accounted for 60 percent of the total MP&M output. Motor vehicles are the largest single MP&M sector, accounting for almost 40 percent of all MP&M output.

While MP&M non-manufacturers outnumbered MP&M manufacturers by more than two to one in 1996, manufacturers' revenues were nearly \$400 billion larger than MP&M non-manufacturers' revenues.

Table 3.2: MP&M Output and Share (millions, \$1992)

Sector	Manufacturers		Non-Manufacturers		Sector Total	
	Output ^a	Share	Output ^a	Share	Output ^a	Share
Aerospace	27,073.9	2.3%			27,073.9	1.4%
Aircraft	104,783.9	8.9%	6,167.6	0.8%	110,951.5	5.7%
Bus & Truck	8,140.2	0.7%	143,806.1	18.6%	151,946.3	7.8%
Electronic Equipment	81,380.7	6.9%			81,380.7	4.2%
Hardware	127,769.0	10.8%			127,769.0	6.6%
Household Equipment	75,552.4	6.4%	2,193.1	0.3%	77,745.5	4.0%
Instruments	111,908.9	9.5%	6,648.1	0.9%	118,557.0	6.1%
Iron and Steel	14,967.3	1.3%			14,967.3	0.8%
Job Shop ^b	9,886.4	0.8%			9,886.4	0.5%
Mobile Industrial Equipment	35,494.9	3.0%			35,494.9	1.8%
Motor Vehicle	265,433.9	22.5%	506,487.4	65.7%	771,921.3	39.6%
Office Machine	66,746.7	5.7%	13,029.6	1.7%	79,776.3	4.1%
Ordnance	6,995.2	0.6%			6,995.2	0.4%
Other Metal Products	51,958.6	4.4%	16,487.9	2.1%	68,446.5	3.5%
Precious Metals and Jewelry	7,986.7	0.7%	274.7	0.0%	8,261.4	0.4%
Printed Wiring Boards	7,311.8	0.6%			7,311.8	0.4%
Railroad	4,588.8	0.4%	28,348.9	3.7%	32,937.7	1.7%
Ships and Boats	15,207.6	1.3%	29,207.2	3.8%	44,414.8	2.3%
Stationary Industrial Equipment	154,689.7	13.1%	18,668.6	2.4%	173,358.3	8.9%
Total MP&M	1,177,876.6	100.0%	771,319.2	100.0%	1,949,195.8	100.0%
<i>Percent of total</i>	<i>60.4%</i>		<i>39.6%</i>		<i>100.0%</i>	

a. Value of shipments for manufacturing industries; total sales for retail and wholesale trade; total receipts for service industries; total revenue for transportation.

b. Includes facilities in two SICs that are defined specifically as job shops (SICs 3471 and 3479.) Facilities reporting in other sectors may also operate as job shops, so these data are likely to understate the true output of MP&M job shops.

Source: Department of Commerce, Bureau of the Census, Census of Manufactures, Census of Transportation, Census of Wholesale Trade, Census of Retail Trade, Census of Service Industries, 1992.

The following sections describe the MP&M sectors and briefly discusses recent industry trends in each sector. The discussion is based on *U.S. Industry and Trade Outlook 2000* (DRI-McGraw Hill), EPA's Sector Notebooks, and other sources.

3.2.1 Aerospace

The aerospace industry includes original equipment manufacturers (OEM) and facilities that rebuild and repair aerospace equipment. The industry serves both military and commercial end-uses such as space vehicles for commercial communication satellites, although military applications dominate. Products include guided missiles and space vehicles, and associated propulsion units and parts. The assembly of aerospace products draws on numerous other industries, including plastics, rubber, fabricated metals, metal casing, glass, textile, and electronic components.

Aerospace products are typically produced by a prime contractor and several tiers of subcontractors. Final assembly is performed by relatively few facilities compared with the numerous subassembly and parts manufacturers.

There has been substantial consolidation in recent years in the U.S. aerospace industry, due to declines in defense spending. The number of facilities and firms as well as sector value of shipments decreased from 1992 to 1996 in the U.S., but value of shipments have rebounded to levels comparable to the 1992 production levels in recent years. This is partially due to replenishing of stocks depleted during the bombing in Kosovo.

Growth in the industry is expected to come from lower cost air-to-air missiles, with strong focus on increasing efficiency in production by reducing costs. There has also been growth in consumer demand for direct-to-home television, voice and

data transmission, and other satellite services which has increased the commercial demand for space vehicles needed to launch satellites.

The aerospace industry exports a substantial share of its output. Many North American and European governments with large defense budgets have been seeking to reduce their military budgets, while governments in South America (with smaller budgets) have been maintaining or increasing their defense spending. There has been substantial consolidation in the European aerospace industry, which has become more competitive with U.S. companies (U.S. EPA 1997; DRI/McGraw Hill 2000).

3.2.2 Aircraft

Trends in the aircraft sector are heavily influenced by changes in industry structure and in the international political-economic arena. There has been substantial restructuring through mergers and consolidation in the aircraft manufacturing industry, including producers of both aircraft and aircraft parts nationally and internationally. Firms are focused on improving efficiency through cost cutting efforts such as reduced staffing. Although there were significant production increases of new aircraft in 1998 and 1999, growth in production is now expected to level off as producers shift their focus to improving the efficiency of existing aircraft.

Global competition in the airline industry may also reduce the demand for U.S. aircraft products in the future. Trade agreements in the European Union (E.U.) are expected to limit the sale of U.S. engines and engine parts. In addition, there is a growing trend for U.S. producers to outsource many aircraft parts to firms in other nations, in order to bring down costs and compete internationally.

In addition to aircraft manufacturing, this sector includes rebuilding and repair of aircraft at manufacturers' facilities or at airports.² Maintenance and repair of aircraft has been influenced by strong growth in both passenger and commercial air traffic and by the maintenance requirements of older aircraft.

3.2.3 Electronic Equipment

The electronic equipment sector can be divided into two general groups of industries: microelectronics manufacturers and telecommunications equipment.

² EPA is proposing to cover wastewater generated from washing vehicles only when it occurs as a preparatory step prior to performing an MP&M unit operation (e.g., prior to disassembly to perform engine maintenance or rebuilding). The proposed rule does not cover the washing of cars, aircraft, or other vehicles when it is performed only for aesthetic/cosmetic purposes.

Microelectronics industries manufacture a wide range of products from electronic connectors to integrated circuit panels. These products are used as material inputs in many industries such as automotive, telecommunications, aerospace, computer, and medical equipment. The telecommunications industry also covers a range of industries. These industries are focused on the production of equipment used in network equipment, fiber optics, and wireless communication equipment.

While the microelectronics industry covers a diverse array of products, producers, and end-uses, there have been a number of general trends in the industry. The electronics sectors have shown very rapid growth over the last two decades. The U.S. is a major producer of electronic products, although Japan is the leading producer of consumer electronics. With a strong increase in the use of microelectronic products in industries throughout the economy, this has been a rapidly growing industry. U.S. firms face strong international competition for cutting edge technological advances in their products. Due to the high skill level necessary in the development of products, there is considerable competition for skilled labor. The recent growth in industry shipments is expected to continue, partially due to the Information Technology Agreement, which seeks to eliminate import duties on information technology products by 2000.

The telecommunications industries have also experienced considerable growth in the past few years. Much of the growth in the industry has come from the growing use of fiber optics and wireless end-user devices. Growth is expected to continue, due in part to the World Trade Organization's Agreement on Basic Telecommunications in 1998, which opened overseas markets to U.S. firms competing to develop telecommunications networks.

3.2.4 Hardware

The hardware sector consists of many different industries, which can be generally classified into three groups: building hardware, conventional hardware, and tooling hardware.

Building hardware consists of a group of industries that manufacture metal building products, including fabricated structural metal, sheet metal work, and architectural metalwork. This group of industries has been growing rapidly throughout the 1990's. The building products industry as a whole saw record sales in 1998 and again in 1999. Much of this growth is attributed to large highway projects funded by the Transportation Efficiency Act for the 21st Century.

Conventional hardware includes products such as screws, industrial fasteners, and valves and hose fittings. The products produced in this industry are used in the production of manufactured goods. Trends in this industry, therefore,

generally reflect trends in other manufacturing industries. A primary industry influencing conventional hardware is the auto industry. Hardware producers have experienced pressures from end users such as auto makers to reduce costs.

The industry faces a continued trend of consolidation of firms and increasing global pressure from countries with low labor costs. Domestic producers of screws and industrial fasteners saw growth in the real value of shipments due to the strong U.S. economy.

The tooling hardware sector also contains a variety of different industries that produce various types of tools for different uses. Because these industries also face continued globalization, many of them are impacted by changes in the global economy. The decline in Asian markets in 1998 and 1999 resulted in a sharp decline in the value of shipments for the machine tooling industries. Prior to the 1998 financial crisis, value of shipments were increasing annually. The market for the power-driven segment of hand tools has increased, however, despite troubled overseas markets.

3.2.5 Household Equipment

There are three general groups of industries included in this sector: household furniture, household appliances, and plumbing equipment. Generally speaking, factors that affect this sector are consistent across these three groups. Low interest rates, low unemployment, and increased disposable income have stimulated growth in each of these industries. Higher interest rates due to intervention from the Federal Reserve and higher consumer prices for energy could result in a leveling off in this industry. Furthermore, all three industries face international competition as imports account for a substantial share of domestic consumption.

Metal furniture accounts for 20 percent of the household furniture industry. Metal components are increasingly being added to non-metal furniture. For example, there is a trend to increase the functionality of non-metal furniture by equipping recliners with heat and massage. This could increase the industry's reliance on metal parts. The industry has integrated vertically, as large manufacturers have begun to open their own retail stores in an effort to differentiate their products.

There are two groups of household appliance manufacturers. Major appliances such as washing machines and refrigerators are produced by relatively few firms. Smaller appliances are characterized by little product differentiation but considerable price competition and are manufactured by a larger number of companies.

Finally, a significant characteristic of the plumbing equipment market is the extent of U.S. dependence on foreign imports. While the U.S. construction market has

grown at a record pace in the past few years, increasing demand for plumbing equipment, much of the demand has been served by imports and this industry has a trade deficit.

3.2.6 Instruments

The instruments sector is characterized by a diverse array of technologically advanced products and intense global competition among many firms of varying sizes. The sector can be generally divided into industrial measuring and testing instruments, and medical instruments.

In the industrial measuring industry, producers of laboratory instruments are typically integrated firms who have consolidated and reduced costs in response to pressures from medical and pharmaceutical customers. Producers of measuring devices are also facing pressures to consolidate. These firms have been hurt by low commodity prices during the past few years, which have led to reduced investment in measuring equipment by fuel and grain producers. Sales should rebound, however, if Asian economies and fuel prices continue to grow. Small companies still dominate the electronic test equipment industry, which is characterized by a high degree of product differentiation. Most of these firms are not large enough to export products.

Sales for medical devices increased steadily throughout the 1990's, while employment remained relatively constant. The industry has historically been characterized by many small to mid-size firms and intense competition for technological innovation. Efforts to bring down health care costs is one of the primary challenges facing this industry. Pressure to reduce costs has reduced insurance companies' willingness to pay for new equipment. As the population ages, however, demand for medical services and devices is expected to grow. The industry should continue to grow through 2004 at a rate of 8 to 10 percent, which is somewhat less than growth in recent years.

3.2.7 Iron and Steel

The basic iron and steel industry is regulated under 40 CFR 420, and primary iron and steel works, blast furnaces and rolling mills are not affected by the proposed MP&M rule. The proposed MP&M rule will regulate facilities that perform MP&M operations or cold forming operations on steel wire, rod, bar, pipe, or tube. This subcategory does not include facilities that perform those operations on base materials other than steel, nor does it include wastewater generated from performing any hot steel forming operations or wastewater from cold forming, electroplating or continuous hot dip coating of steel sheet, strip, or plates.

Events in the global steel industry in the past few years have had significant and possibly far reaching impacts on domestic producers. In 1998, the industry experienced a global steel crisis. This crisis was caused in part by the

Asian financial crisis, which triggered a sharp decline in imports of steel by major steel importing countries of Asia. This led to a flood of steel imports into U.S., and U.S. steel imports rose 33 percent in 1998. The situation was made worse by global overcapacity largely derived from producers in Russia and Latin America.

This flood of steel into the U.S. and Europe led to rapidly declining steel prices in both regions. The “unfair” trading prices resulted in over 20 nations taking formal trade protection actions such as import duties and price floors. Excess inventories that accrued during the surge of imports hurt domestic producers. These inventories were expected to be exhausted by 2000. The steel industry is projected to grow along with the economy at a rate of 1 to 2 percent per year through 2004.

3.2.8 Job Shops

MP&M metal finishing job shops are defined as those facilities with more than 50 percent of their revenues coming from products not owned by the site. While there are specific SIC codes associated with some Metal Finishing Job Shops, they sell to a variety of markets and are not a market in and of themselves.

3.2.9 Motor Vehicle and Bus & Truck

The major trend in these industries is the continual consolidation of firms into globalized manufacturers. Motor vehicle manufacturers are no longer constrained within national boundaries, as mergers and joint ventures include some of the largest firms from different countries. Many foreign owned manufacturers have facilities located in the U.S., and relative production costs and exchange rates play a greater role in determining the location of production facilities than the national identity of parent companies.

Manufacturers have increasingly standardized the design of motor vehicles and their parts. These changes have resulted in much less product differentiation among manufacturers, but also in greater product quality. However, greater product quality has resulted in a consistently sharp increase in price over the past three decades. This price increase may have reached its pinnacle as prices have declined in 1998 and 1999. The real value of shipments for automobiles increased 1.3 percent between 1996 and 2000.

3.2.10 Mobile Industrial Equipment

Mobile industrial equipment is divided among a number of different industry segments that produce machinery for different sets of end-users. Growth in the construction equipment industry is typically tied to economic factors such as housing starts, employment, and consumer confidence. Shipments of construction equipment have risen steadily during much of the 1990's. However, they have begun to

level off in 1999 and 2000. This is partially due to a decline in demand caused by the Asian crisis, but may also reflect a slowdown in the residential construction market. This decline in demand may be offset by new spending from Federal, State, and local governments in response to the 1998 Transportation Equity Act for the 21st Century.

The farm and mining machinery industries both have been suffering from low commodity prices. Both industries experienced growth in shipments throughout much of the 1990's, but were hit in 1999 by low prices. Farm equipment was hit hardest as the real value of shipments fell by 38 percent in 1999. Output is expected to continue to decrease until grain surpluses decline and agricultural prices rise. Declining world prices is only one of a number of trends impacting the industry for agricultural production equipment. The consolidation of farms has also had a significant impact on this industry. With the increase in farm size, there is growing dependence upon mechanization to farm more acres per farm.

3.2.11 Office Machine

The office machine sector is a rapidly growing and dynamic global market. The industry has experienced 7.8 percent growth in the real value of shipments between 1996 and 2000. While this growth was accomplished with only a 1.3 percent increase in total employment, production employment increased by 5.4 percent. The relative difference between total and production employment can be attributed to increasing reliance on the Internet for sales, thereby reducing the need for non-production employment. The industry has undergone mergers and acquisitions to bring down costs in order to compete. Firms also rely on joint venturing agreements. Firms are forming alliances with past competitors to produce complementary components of new technologies. Consolidation also allows firms to diversify, providing a range of products such as PCs, software, and information technology to protect against the strong competition in the market for any one product. Firms have also increasingly outsourced production to electronics manufacturers more equipped to increase production and take advantage of economies of size, while the original firms utilize their resources for research and development of new technologies to stay competitive.

Globalization is an important trend in this industry as machine components are produced in different countries. Despite the trend toward a globalized market, the U.S. has held a negative trade balance for over a decade. In recent years, this has partially been due to the Asian financial crisis. As Asian economies continue to recover the trade balance is expected to improve for the U.S.

3.2.12 Precious Metals and Jewelry

Domestic production in this industry is dominated by many small firms, mostly concentrated in the northeast U.S., and is impacted by trends in consumer behavior and the retail market. Global competition has a significant impact on the competitiveness of domestic firms. These factors have provided both favorable and unfavorable conditions to the industry.

Strong consumer spending on precious metals and costume jewelry has been fueled by increased disposable income. Devaluation in the price of gold due to declining world prices has also benefitted the industry because it reduces the cost of making jewelry.

Increases in spending have not necessarily translated into gains for domestic producers. The lowering of tariffs has resulted in a steady increase in imports of costume jewelry, as labor-intensive production is often less expensive in developing countries. Domestic producers are also hurt by the strong U.S. dollar, which makes U.S. exports more expensive. Another challenge comes from the retail market, which has put strong pressure on producers to bring down prices in order to compete. These challenges include consolidation of retailers, giving them greater purchasing power, increased Internet and television home shopping, and a decrease in the number of wholesalers. The *U.S. Industry & Trade Outlook 2000* projects minimal growth in the precious metals industry of 1 percent through 2004 and a decline in costume jewelry of 2 percent.

3.2.13 Printed Wiring Boards

Printed wiring boards (also referred to as printed wiring boards) are the physical structures on which electronic components such as semiconductor and capacitors are mounted. Computers and communications are the largest uses for printed wiring boards. In addition, printed wiring boards are used in a wide array of other products, including toys, radios, television sets, electronic wiring in cars, guided-missile and airborne electronic equipment, biotechnology, medical devices, digital imaging equipment, and industrial control equipment.

While some producers of PWBs produce them for their own use, most manufacturers are independent firms that sell PWBs to the open market. The majority of PWB manufacturers are small firms.

The domestic industry has experienced considerable growth throughout the 1990's. There is growing international pressure to bring down costs, however, in order to compete in the global economy. The real value of shipments grew nine percent from 1996 to 2000. Growth has been spurred by continual growth in end-use markets. In addition to the increase value of shipments, U.S. firms have seen a 5.6

percent increase in average hourly earnings and a 16.3 percent increase in capital expenditures. High costs inhibit the competitiveness of U.S. firms as they are already facing tight competition from Asian producers. Consequently, many of the larger firms are looking to relocate offshore.

3.2.14 Railroad

Railroad service consists of both freight and passenger service. In the past few years, railroad companies have been focusing on improving the efficiency of their lines and services. There has been a continued trend toward consolidation of major freight railroads. Consequently, companies have reduced the number of lines and focused attention on increasing the capacity of fewer lines.

Since the 1980's railroad traffic increased by 50 percent, while the line network decreased by 39 percent. This was accomplished by increasing capital expenditures for equipment such as new locomotives with greater horsepower, installation of double tracks, and increases in the capacity of non-railroad owned freight cars. Consequently, freight service saw the first increase in operating revenue since 1984, although this was coupled with sharp decreases in employment. Passenger service has undergone similar changes to increase efficiency by adding new locomotives and beginning a transition to high speed train service.

3.2.15 Ships and Boats

Ship manufacturing has experienced continual declines throughout the 1990's. Despite efforts by the Federal Government to stimulate investment in converting the industry from production of military ships to merchant ships, the U.S. Navy remains the primary customer of shipbuilders. The U.S. Navy has dramatically reduced its orders for new vessels since the end of the Cold War, and decommissioned many ships and submarines. The Navy decreased its fleet by 208 ships from 1985 to 1998. Although the Navy plans to add 66 new ships through construction and conversion from 2000 through 2004, this represents a decline of over 60 percent in the procurement of new ships since the 1980's. The ship building industry should be helped, however, by the Oil Pollution Act of 1990, which requires all oil tankers entering U.S. ports to have double hulls.

This sector also manufactures boats, with sales that reflect overall trends in recreational expenditures. The U.S. boat building business is the world's leading supplier of recreational craft. Rapid growth in the market for smaller personal water craft (e.g., jet skis) has led to an increase in imports of boats.

3.2.16 Stationary Industrial Equipment

The stationary industrial equipment sector includes machinery used in a number of industries, as well as machinery parts. These industries produce machinery used for oil, paper, and food production, printing and packaging, as well as heaters and air conditioners, electric generating equipment, and motor generators. These industries also produce large metal-working machines used in making parts for other industries.

The industries supplying oil and gas production, paper production, and printing machinery were impacted by similar global factors, and consequently followed similar trends. Oil production was impacted by low petroleum prices in 1998. Gas production has also been influenced by low oil prices, which puts pressure on the gas industry to reduce costs in order to compete. These factors led to a decline of 38 percent in the real value of shipments in 1998 and 1999, although the price of petroleum has increased in 1999 and 2000 and machinery shipments grew 9.2 percent.

Paper manufacturing equipment has also suffered from events overseas. Although the U.S. has seen a decline in the production of paper throughout the latter half of the 1990's, the U.S. remains the largest producer of paper manufacturing machinery. The industry therefore relies heavily on exports to sustain growth. With struggling economies overseas, the industry saw a decline in the annual value of shipments from 1996 to 2000. The printing industry was also impacted by the Asian economy. Printing machinery manufacturers realized strong growth during the first half of the 1990's due to increased demand for new digital presses, but a decline in exports resulted in slower growth for the later half of the decade. Global events did not have such an impact on manufacturers of packaging machinery, as the U.S. is not only the leading producer of this equipment but also its leading end-user.

A variety of industries manufacture equipment used to produce energy or to power equipment. Refrigeration, air conditioning, and heating equipment sales tend to follow growth in housing starts and construction of new office buildings. A number of factors contributed to strong growth in this industry throughout the 1990's including record housing starts, record heat in the summer of 1999,

replacement of chlorofluorocarbon (CFC) air conditioning units, and a large percentage of new homes being built with central air conditioning. With 66 percent of the existing air conditioners containing CFC technology still in operation, replacement of these machines provides an opportunity for growth in this industry in the future. However, with rising interest rates in the past few years, housing starts are expected to slow, which should moderate growth.

Turbines, transformers, and switchboards are all used for the production of electricity, which saw considerable growth from 1990 to 1998 as the domestic economy grew. This growth was also impacted by the financial crisis in Asia, however. A number of advanced technologies have been developed to meet the demands of a deregulated industry. These technologies are capable of producing electricity from smaller facilities at competitive costs. Implementation of these technologies is not expected to take place for a few years, however, as the effects of deregulation become clearer. Consequently, growth is expected to be slow through 2004.

3.3 CHARACTERISTICS OF MP&M MANUFACTURING SECTORS

The analyses presented in this section cover a nine year period from 1988 to 1996. The data come primarily from the 1992 *Economic Censuses* and from the *Annual Survey of Manufactures* for other years. Data are presented over nine years rather than ten because data are incomplete in the *Annual Survey of Manufactures* for many SIC codes in 1987. OMB reclassified a number of 4-digit SIC industries in 1987 which made it difficult to compare SIC codes before and after this reclassification.

Trends in dollar values are shown in real terms, using the **Producer Price Index (PPI)** for industrial commodities. The PPI is family of indexes that measure price changes from the perspective of the seller. This profile uses the PPI to inflate nominal monetary values to constant dollars. The PPI for industrial commodities increased slightly every year between 1987 and 1996. Table 3.3 shows the index values for the relevant years.

Year	Producer Price Index (PPI)	Percent Change
1987	102.6	n/a
1988	106.3	3.6%
1989	111.6	5.0%
1990	115.8	3.8%
1991	116.5	0.6%
1992	117.4	0.8%
1993	119	1.4%
1994	120.7	1.4%
1995	125.5	4.0%
1996	127.3	1.4%

Source: Bureau of Labor Statistics, Producer Price Index.

3.3.1 Domestic Production

a. Output

The two most common measures of manufacturing output are **value of shipments (VOS)** and **value added (VA)**. Historical trends in these measures provide insight into the overall economic health of an industry. Value of shipments is the sum of the receipts a manufacturer earns from the sale of its outputs. It is an indicator of the overall size of a market or the size of a firm in relation to its market or competitors. Value added is used to measure the value of production activity in a particular industry. It is the difference between the value of shipments and the value of purchased non-labor inputs used to make the products sold.

Table 3.4 presents the trend in value of shipments and value added by MP&M sector during the period 1988 to 1996.

The aerospace and ordnance industries experienced a significant decline in VOS and VA over this period. Aerospace value of shipments had a negative average annual growth rate of 7.6 percent, due to the decreased military spending during the last. Aerospace VOS has risen in recent years, however, due in part to replenishing of stocks depleted during the bombing in Kosovo. Railroad equipment manufacturers enjoyed an average annual growth of 7.6 percent in VOS, after some years of decline. Electronic equipment experienced the next largest average growth, with annual growth in VOS averaging 5.1 percent, due primarily to the rapid growth in the use of microelectronics in industries throughout the economy. Ship and boat manufacture experienced continual declines throughout the 1990's. The U.S. Navy remains the primary customer of shipbuilders and the Navy has reduced its fleet since the end of the Cold War.

Table 3.4: Real Value of Shipments and Value Added: MP&M Manufacturing Sectors (millions, \$1996)

Sector	Value of Industry Shipments			Value Added by Manufacture		
	1988	1996	Average Annual Growth Rate	1988	1996	Average Annual Growth Rate
Aerospace	33,763	17,928	-7.6%	22,671	9,986	-9.7%
Aircraft	95,268	83,394	-1.7%	48,492	45,220	-0.9%
Bus & Truck	9,234	13,473	4.8%	3,398	5,172	5.4%
Electronic Equipment	80,206	119,464	5.1%	45,837	62,919	4.0%
Hardware	143,151	169,567	2.1%	77,528	92,566	2.2%
Household Equipment	82,331	92,649	1.5%	39,958	42,731	0.8%
Instruments	110,998	127,935	1.8%	73,322	83,540	1.6%
Iron and Steel	18,195	18,727	0.4%	6,781	6,663	-0.2%
Job Shops	11,007	14,003	3.1%	6,536	7,793	2.2%
Mobile Industrial Equipment	42,355	52,683	2.8%	20,034	22,798	1.6%
Motor Vehicle	296,102	363,557	2.6%	100,400	122,541	2.5%
Office Machine	81,007	103,270	3.1%	40,346	41,135	0.2%
Ordnance	9,607	5,222	-7.3%	6,221	3,528	-6.8%
Other Metal Products	55,169	60,034	1.1%	33,808	35,114	0.5%
Precious Metals and Jewelry	10,122	8,670	-1.9%	4,707	4,130	-1.6%
Printed Wiring Boards	9,533	10,702	1.5%	5,560	6,564	2.1%
Railroad	3,935	7,067	7.6%	1,776	2,590	4.8%
Ships and Boats	17,638	15,634	-1.5%	9,462	7,903	-2.2%
Stationary Industrial Equipment	166,007	221,591	3.7%	91,360	117,678	3.2%
Total	1,275,628	1,505,570	2.1%	638,197	720,571	1.5%

Source: Department of Commerce, Bureau of the Census, Annual Survey of Manufactures.

b. Number of facilities and firms

Table 3.5 shows the number of facilities between 1989 and 1996 and the number of firms between 1990 and 1996. The aerospace industry is the only MP&M manufacturing sector experiencing significant downsizing, with the numbers of

firms and facilities decreasing annually by 4.1 and 4.2 percent, respectively. The iron and steel industry experienced a modest decrease in number of firms and facilities.

Sector	Number of Firms			Number of Facilities		
	1990	1996	Average Annual Growth Rate	1989	1996	Average Annual Growth Rate
Aerospace	109	85	-4.1%	143	106	-4.2%
Aircraft	1,428	1,486	0.7%	1,633	1,691	0.5%
Bus & Truck	889	953	1.2%	1,016	1,040	0.3%
Electronic Equipment	5,649	6,180	1.5%	6,396	6,693	0.7%
Hardware	34,984	37,832	1.3%	37,861	40,044	0.8%
Household Equipment	6,787	7,563	1.8%	7,914	8,303	0.7%
Instruments	7,963	9,730	3.4%	8,959	10,552	2.4%
Iron and Steel	597	583	-0.4%	784	770	-0.3%
Job Shop	4,798	5,280	1.6%	5,104	5,549	1.2%
Mobile Industrial Equipment	3,318	3,341	0.1%	3,606	3,591	-0.1%
Motor Vehicle	4,991	6,044	3.2%	5,977	7,024	2.3%
Office Machine	1,828	2,002	1.5%	2,050	2,087	0.3%
Ordnance	340	421	3.6%	385	442	2.0%
Other Metal Products	11,517	13,819	3.1%	12,069	14,198	2.3%
Precious Metals and Jewelry	3,719	3,867	0.7%	3,870	3,892	0.1%
Printed Wiring Boards	1,034	1,452	5.8%	1,046	1,530	5.6%
Railroad	147	152	0.6%	180	215	2.6%
Ships and Boats	2,511	3,195	4.1%	2,708	3,310	2.9%
Stationary Industrial Equipment	35,231	40,618	2.4%	37,261	42,317	1.8%
Total	127,840	144,603	2.1%	138,962	153,354	1.4%

Source: Small Business Administration, Statistics of U.S. Businesses.

c. Employment

Employment is a measure of the level and trend of activity in an industry. While employment growth generally signals economic strength in an industry, strong productivity growth and scale economies can yield growth in revenues that exceeds growth in employment.

Table 3.6 shows that employment in the MP&M manufacturing sectors as a whole decreased modestly between 1988 and 1997, declining at an average rate of 0.7 percent annually. The aerospace, ordnance, and aircraft sectors experienced the largest decreases in employment from 1988 to 1996. The electronic equipment sector showed the most growth in output but had less than 0.01 percent increase in employment, reflecting an increase in real productivity.

Table 3.6: Employment: MP&M Manufacturing Sectors			
Sector	Number of Employees		
	1988	1996	Average Annual Growth Rate
Aerospace	223,700	81,000	-11.9%
Aircraft	596,600	376,800	-5.6%
Bus & Truck	63,900	67,700	0.7%
Electronic Equipment	602,500	604,800	0.0%
Hardware	1,246,200	1,307,600	0.6%
Household Equipment	584,900	570,600	-0.3%
Instruments	886,500	753,800	-2.0%
Iron and Steel	65,500	67,900	0.5%
Job Shops	123,300	129,200	0.6%
Mobile Industrial Equipment	232,400	232,600	0.0%
Motor Vehicle	928,000	974,000	0.6%
Office Machine	329,800	259,100	-3.0%
Ordnance	86,500	40,200	-9.1%
Other Metal Products	368,100	361,400	-0.2%
Precious Metals and Jewelry	87,100	65,800	-3.4%
Printed Wiring Boards	80,900	88,300	1.1%
Railroad	25,900	30,600	2.1%
Ships and Boats	182,900	141,300	-3.2%
Stationary Industrial Equipment	1,269,800	1,396,900	1.2%
Total	7,984,500	7,549,600	-0.7%

Source: Department of Commerce, Bureau of the Census, Annual Survey of Manufactures.

d. Capital expenditures

New capital expenditures are needed to modernize, expand, and replace existing capacity to meet growing demand. Table 3.7 presents new capital expenditures by sector. In

general, the MP&M industries increased their capital expenditures by 4.3 percent annually. The only sectors that had a decline in spending on new capital were aerospace, aircraft, ordnance, and ships and boats.

Table 3.7: New Capital Expenditures: MP&M Manufacturing Sectors (millions, \$1996)			
Sector	1988	1996	Average Annual Growth Rate
Aerospace	1,229	490	-10.9%
Aircraft	2,828	2,023	-4.1%
Bus & Truck	151	200	3.6%
Electronic Equipment	2,925	4,205	4.6%
Hardware	3,299	5,276	6.0%
Household Equipment	2,017	2,454	2.5%
Instruments	3,754	4,533	2.4%
Iron and Steel	394	584	5.0%
Job Shops	331	724	10.3%
Mobile Industrial Equipment	1,052	1,052	0.0%
Motor Vehicle	5,344	12,045	10.7%
Office Machine	2,856	2,917	0.3%
Ordnance	184	85	-9.2%
Other Metal Products	1,659	1,875	1.5%
Precious Metals and Jewelry	87	146	6.7%
Printed Wiring Boards	403	585	4.8%
Railroad	73	97	3.6%
Ships and Boats	453	351	-3.1%
Stationary Industrial Equipment	4,065	6,775	6.6%
Total	33,104	46,417	4.3%

Source: Department of Commerce, Bureau of the Census, Annual Survey of Manufactures.

3.3.2 Industry Structure and Competitiveness

This profile shows facility and firm size and data on foreign trade as measures of industry structure and competitiveness in MP&M manufacturing.

a. Facility size

In general, the MP&M industries are characterized by a large number of small businesses. Table 3.8 shows that approximately 98 percent of all MP&M facilities employ 500 employees or less. However, those facilities only account for 39 percent of the value of shipments. Hardware and stationary industrial equipment represent 55 percent of the facilities employing 19 people or less.

**Table 3.8: Number of Facilities and Value of Shipments by Facility Employment Size Category:
MP&M Manufacturing Sectors**

Sector	Number of Facilities					Value of Shipments (millions, \$1992)				
	1 to 19	20 to 99	100 to 499	500 to 2,499	2,500 or more	1 to 19	20 to 99	100 to 499	500 to 2,499	2,500 or more
Aerospace	39	23	35	24	19	207	70	1,045	5,601	20,151
Aircraft	900	466	257	85	37	551	2,208	7,053	26,194	68,778
Bus & Truck	557	313	128	17	0	411	1,636	3,854	2,240	0
Electronic Equipment	3,898	2,207	934	154	17	2,316	10,483	24,378	37,418	6,786
Hardware	26,790	10,866	2,247	151	1	15,861	47,999	49,569	14,341	0
Household Equipment	5,160	2,165	1,050	171	8	2,950	10,215	31,278	29,064	2,044
Instruments	6,295	2,490	1,152	296	31	3,901	12,778	32,448	44,457	18,324
Iron and Steel	297	278	182	15	0	397	3,469	8,147	2,956	0
Job Shop	3,651	794	144	2	0	1,725	3,580	3,262	0	0
Mobile Industrial Equipment	2,362	927	326	63	8	1,578	5,009	10,815	18,093	0
Motor Vehicle	3,604	1,625	1,002	235	72	2,714	9,256	34,923	105,710	112,831
Office Machine	1,370	526	232	83	16	1,197	4,714	11,994	27,405	21,437
Ordnance	264	77	58	26	4	94	281	1,769	4,851	0
Other Metal Products	10,483	2,207	558	59	4	4,384	9,139	14,960	23,475	0
Precious Metals and Jewelry	3,251	528	120	11	0	1,643	2,370	3,731	243	0
Printed Wiring Boards	735	423	149	16	1	367	1,614	2,510	2,821	0
Railroad	83	81	30	10	2	92	596	1,102	2,799	0
Ships and Boats	2,373	467	182	25	6	851	1,822	3,947	2,222	6,366
Stationary Industrial Equipment	29,234	7,799	2,101	294	10	13,950	33,892	59,180	43,331	4,337
Total	101,346	34,262	10,887	1,737	236	55,188	161,132	305,963	393,220	261,054

Source: Department of Commerce, Bureau of the Census, Census of Manufactures, 1992.

b. Firm size

The Small Business Administration (SBA) defines small businesses according to the firms' number of employees. Table 3.9 shows that 141,048 (92 percent) of all MP&M manufacturing facilities are owned by firms that employ 500

or fewer workers and would therefore be considered small businesses. The remaining 12,306 facilities are owned by firms that employ more than 500 workers and account for 72 percent of total estimated receipts.

Table 3.9: Number of Firms, Facilities, and Estimated Receipts by Firm Employment Size Category, 1996: MP&M Manufacturing Sectors

Sector	Firms			Facilities			Estimated Receipts (millions, \$1996)		
	1 to 99	100 to 499	500 or more	1 to 99	100 to 499	500 or more	1 to 99	100 to 499	500 or more
Aerospace	51	2	32	51	2	53	0	0	17,851
Aircraft	1,209	135	142	1,212	158	321	2,301	2,664	88,050
Bus & Truck	805	92	56	810	107	123	2,129	2,475	6,287
Electronic Equipment	4,936	681	563	4,977	786	930	11,404	16,279	76,563
Hardware	34,162	2,345	1,325	34,398	2,968	2,678	62,437	39,927	57,501
Household Equipment	6,408	665	490	6,455	791	1,057	12,007	16,334	62,299
Instruments	8,273	727	730	8,320	842	1,390	16,180	15,238	90,897
Iron and Steel	362	108	113	368	153	249	1,890	4,152	11,949
Job Shops	4,945	240	95	5,001	338	210	6,714	3,271	2,905
Mobile Industrial Equipment	2,875	263	203	2,898	319	374	6,255	5,930	30,140
Motor Vehicle	4,950	614	480	4,987	724	1,313	10,614	20,053	343,942
Office Machine	1,662	167	173	1,668	180	239	5,040	7,069	60,436
Ordnance	358	25	38	358	28	56	309	425	3,952
Other Metal Products	13,097	492	230	13,152	602	444	12,728	10,073	28,778
Precious Metals and Jewelry	3,747	86	34	3,753	89	50	3,339	1,894	2,015
Printed Wiring Boards	1,250	137	65	1,258	150	122	2,093	2,253	5,412
Railroad	99	24	29	101	30	84	306	465	5,883
Ships and Boats	3,003	137	55	3,012	165	133	2,532	2,771	10,789
Stationary Industrial Equipment	37,669	1,691	1,258	37,835	2,002	2,480	49,438	33,418	111,831
Total	129,861	8,631	6,111	130,614	10,434	12,306	207,715	184,691	1,017,479

Source: Small Business Administration, Statistics of U.S. Businesses, 1996.

c. Foreign trade

This profile uses two measures of foreign competitiveness: **export dependence** and **import penetration**. Export dependence is the share of value of shipments that is exported. Import penetration is the share of domestic consumption met by imports. For both measures, a high value indicates a relatively high dependence on foreign markets.

Table 3.10 shows that in the U.S., the four industries with the highest level of domestic consumption were motor

vehicles, stationary industrial equipment, hardware, and electronic equipment. Of these four industries, stationary industrial equipment is the only industry with positive net exports (exports minus imports) in 1999. Overall, the U.S. was a net importer of MP&M manufactured goods. The table also shows that there is global competition in many of the MP&M industries, which is illustrated by the number of industries that have both large export dependence and import penetration. For example, roughly 89 percent of U.S. consumption of precious metals is met by imports, while almost 70 percent of U.S. production is sold as exports.

Table 3.10: Trade Statistics, 1999: MP&M Manufacturing Sectors

Sector	Value of Imports (millions, 1999\$)	Value of Exports (millions, 1999\$)	Value of Shipments (millions, 1999\$)	Implied Domestic Consumption ^a	Import Penetration ^b	Export Dependence ^c
(a)	(b)	(c)	(d)	(e)	(f)	(g)
Aerospace	250	276	17,816	17,789	1.4%	1.6%
Aircraft	23,725	60,749	82,870	45,846	51.7%	73.3%
Bus & Truck	740	691	13,388	13,437	5.5%	5.2%
Electronic Equipment	61,944	37,355	118,714	143,303	43.2%	31.5%
Hardware	30,221	21,850	168,502	176,873	17.1%	13.0%
Household Equipment	50,530	14,664	92,066	127,933	39.5%	15.9%
Instruments	24,404	36,421	127,131	115,114	21.2%	28.6%
Iron and Steel	1,070	341	18,609	19,338	5.5%	1.8%
Job Shops ^d			13,915			
Mobile Industrial Equipment	13,473	14,222	52,352	51,604	26.1%	27.2%
Motor Vehicle	161,632	64,800	361,272	458,104	35.3%	17.9%
Office Machine	63,717	47,637	102,621	118,701	53.7%	46.4%
Ordnance	717	2,147	5,189	3,758	19.1%	41.4%
Other Metal Products	27,573	10,415	59,657	76,815	35.9%	17.5%
Precious Metals and Jewelry	20,444	6,007	8,616	23,053	88.7%	69.7%
Printed Wiring Boards	2,265	2,570	10,634	10,330	21.9%	24.2%
Railroad	2,056	1,238	7,023	7,840	26.2%	17.6%
Ships and Boats	1,062	1,612	15,536	14,987	7.1%	10.4%
Stationary Industrial Equipment	48,319	57,313	220,198	211,204	22.9%	26.0%
Total	534,141	380,305	1,496,107	1,649,943	32.4%	25.4%

a. Implied domestic consumption based on value of shipments, imports, and exports [column d + column b - column c].

b. Import penetration based on implied domestic consumption and imports [column b / column e].

c. Export dependence based on value of shipments and exports [column c / column d].

d. As explained in the text, job shops include only two SICs specific to job shops, and not facilities in other SICs that may be operating as job shops.

Note: components may not sum to totals due to rounding.

Source: Department of Commerce, Bureau of the Census.

Table 3.11 shows the change in the value of exports and imports from 1996 to 1999. In 1996 the U.S. had negative net exports from MP&M industries, reflecting a trade deficit of \$70.6 million. That trade deficit increased in 1999 by roughly \$83.2 million to about \$153.8 million. As is discussed in greater detail in Section 3.4, exports for a

number of the MP&M industries grew slower from 1996 to 1999 than in previous years due to financial crises in Asia and Latin America, while the strong domestic economy and low commodity prices resulted in increased growth in imports.

Sector	Value of Imports (millions, 1999\$)			Value of Exports (millions, 1999\$)		
	1996	1999	Average Annual Growth Rate	1996	1999	Average Annual Growth Rate
Aerospace	133	250	23.4%	133	276	27.6%
Aircraft	13,065	23,725	22.0%	38,479	60,749	16.4%
Bus & Truck	382	740	24.7%	406	691	19.4%
Electronic Equipment	29,344	61,944	28.3%	28,539	37,355	9.4%
Hardware	24,939	30,221	6.6%	19,166	21,850	4.5%
Household Equipment	37,938	50,530	10.0%	15,669	14,664	-2.2%
Instruments	17,702	24,404	11.3%	29,329	36,421	7.5%
Iron and Steel	874	1,070	7.0%	245	341	11.7%
Job Shops						
Mobile Industrial Equipment	10,044	13,473	10.3%	15,506	14,222	-2.8%
Motor Vehicle	115,783	161,632	11.8%	56,878	64,800	4.4%
Office Machine	62,534	63,717	0.6%	44,543	47,637	2.3%
Ordnance	604	717	5.9%	2,603	2,147	-6.2%
Other Metal Products	23,568	27,573	5.4%	10,481	10,415	-0.2%
Precious Metals and Jewelry	14,765	20,444	11.5%	4,295	6,007	11.8%
Printed Wiring Boards	2,486	2,265	-3.1%	1,815	2,570	12.3%
Railroad	1,126	2,056	22.2%	720	1,238	19.8%
Ships and Boats	1,008	1,062	1.8%	1,007	1,612	17.0%
Stationary Industrial Equipment	36,178	48,319	10.1%	52,049	57,313	3.3%
Total	392,473	534,142	10.8%	321,863	380,308	5.7%

Source: Department of Commerce, Bureau of the Census.

3.3.3 Financial Condition and Performance

Operating margin is a partial measure of industry financial performance. Operating margin is defined as VOS less annual payroll and cost of materials as a percent of VOS. This is a partial measure of profitability, as it does not take into account costs associated with capital expenditures or energy.

Table 3.12 presents the operating margins for each industry for the years 1988 and 1996, as well as the change in

operating margin between the two years. Table 3.12 shows that ten MP&M manufacturing sectors experienced increases in their operating margins during the time period, while nine industries experienced decreases. The greatest increases in operating margin occurred in the aircraft, motor vehicles, and bus & truck industries, and the greatest decreases occurred in the aerospace, office machine, and other metal products industries. Ten industries had increases greater than 1 percentage point, and four had operating margins that decreased by more than 1 percentage point.

Table 3.12: Operating Margin: MP&M Manufacturing Sectors (millions, \$1996)			
Sector	1988	1996	Change in Operating Margin
Aerospace	32.4%	28.9%	-3.5%
Aircraft	20.6%	26.7%	6.1%
Bus & Truck	18.5%	24.4%	5.9%
Electronic Equipment	32.0%	33.8%	1.8%
Hardware	27.5%	29.7%	2.2%
Household Equipment	29.7%	29.5%	-0.2%
Instruments	37.1%	41.1%	4.0%
Iron and Steel	23.2%	22.9%	-0.3%
Job Shops	31.8%	30.8%	-1.0%
Mobile Industrial Equipment	27.9%	28.2%	0.3%
Motor Vehicle	20.9%	22.4%	1.5%
Office Machine	31.7%	30.2%	-1.5%
Ordinance	34.3%	39.6%	5.3%
Other Metal Products	41.9%	40.4%	-1.5%
Precious Metals and Jewelry	27.9%	28.2%	0.3%
Printed Wiring Boards	37.2%	36.8%	-0.4%
Railroad	22.4%	22.1%	-0.3%
Ships and Boats	23.2%	22.5%	-0.7%
Stationary Industrial Equipment	29.4%	31.5%	2.1%

Operating Margin is calculated as (value of shipments - cost of materials - payroll)/value of shipments

Source: Department of Commerce, Bureau of the Census, Annual Survey of Manufactures.

3.4 CHARACTERISTICS OF MP&M NON-MANUFACTURING SECTORS

Eleven of the 18 MP&M sectors include non-manufacturing industries. The non-manufacturing activities are defined by 50 4-digit SIC codes: 26 transportation SIC codes, 18 service SIC codes, five retail trade SIC codes, and one wholesale trade SIC code. MP&M facilities may perform both manufacturing and non-manufacturing activities.

The analyses presented in this section cover 1992 only, because the Census does not collect data annually for non-manufacturing SICs as it does for manufacturers in the

Annual Survey of Manufacturers. The profile is based on data from the 1992 Censuses of Transportation, Communications, and Utilities; Service Industries; Retail Trade; and Wholesale Trade.

3.4.1 Domestic Production

a. Output

Table 3.13 shows sales or receipts by sector for the MP&M non-manufacturing SIC codes. Motor vehicles repair and maintenance accounts for almost 66 percent of the total MP&M non-manufacturing sales and receipts.

Table 3.13: Sales/Receipts: MP&M Non-Manufacturing Sectors
(millions, \$1992)

Sector	Output ^a	Share
Aircraft	6,168	0.8%
Bus & Truck	143,806	18.6%
Household Equipment	2,193	0.3%
Instruments	6,648	0.9%
Motor Vehicle	506,487	65.7%
Office Machine	13,030	1.7%
Other Metal Products	16,488	2.1%
Precious Metals and Jewelry	275	0.0%
Railroad	28,349	3.7%
Ships and Boats	29,207	3.8%
Stationary Industrial Equipment	18,669	2.4%
Total	771,319	100.0%

a. Total sales for retail and wholesale trade, total receipts for service industries, total revenue for transportation.

Source: Department of Commerce, Bureau of the Census, Census of Transportation, Census of Wholesale Trade, Census of Retail Trade, Census of Service Industries, 1992.

b. Number of facilities and firms

Table 3.14 shows the number of facilities and firms in the MP&M non-manufacturing sectors, with average annual growth rates. There was a positive growth rate from 1989 to

1996 in all of the industries. Office machines, aircraft, bus and truck, and ships and boats were the fastest growing over the time period. The number of office machine facilities grew by approximately 20 percent annually.

Table 3.14: Number of Firms and Facilities: MP&M Non-Manufacturing Sectors

Sector	Number of Firms			Number of Facilities		
	1990	1996	Average Annual Growth Rate	1989	1996	Average Annual Growth Rate
Aircraft	2,024	3,281	8.4%	2,463	4,062	7.4%
Bus & Truck	74,719	113,840	7.3%	88,128	127,675	5.4%
Household Equipment	3,234	3,706	2.3%	3,367	3,935	2.3%
Instruments	7,214	7,444	0.5%	8,365	9,185	1.3%
Motor Vehicle	183,986	213,355	2.5%	203,592	234,542	2.0%
Office Machine	9,206	32,916	23.7%	9,714	35,150	20.2%
Other Metal Products	32,865	36,290	1.7%	34,683	37,902	1.3%
Precious Metals and Jewelry	1,379	1,625	2.8%	1,535	1,838	2.6%
Ships and Boats	5,739	8,290	6.3%	6,561	9,262	5.0%
Stationary Industrial Equipment	14,672	15,075	0.5%	20,880	21,791	0.6%
Total	335,038	435,822	4.5%	379,288	485,342	3.6%

Source: Small Business Administration, Statistics of U.S. Businesses.

c. Employment

Table 3.15 shows employment in each non-manufacturing MP&M sector in 1992. The bus and truck and motor

vehicle sectors employ nearly 77 percent of all the non-manufacturing MP&M employment.

Table 3.15: Employment, 1992: MP&M Non-Manufacturing Sectors		
Sector	Employment	Share
Aircraft	79,953	1.7%
Bus & Truck	1,683,432	35.9%
Household Equipment	23,681	0.5%
Instruments	108,761	2.3%
Motor Vehicle	1,910,701	40.8%
Office Machine	120,804	2.6%
Other Metal Products	213,242	4.6%
Precious Metals and Jewelry	5,141	0.1%
Railroad	197,421	4.2%
Ships and Boats	171,314	3.7%
Stationary Industrial Equipment	168,850	3.6%
Total	4,683,300	100.0%

Source: Department of Commerce, Census of Transportation, Census of Wholesale Trade, Census of Retail Trade, Census of Service Industries, 1992.

3.4.2 Industry Structure and Competitiveness

a. Facility size

The non-manufacturing facilities tend to be smaller than manufacturing facilities. There are 204,586 facilities (54.3

percent) that employ 4 employees or less. These facilities account for 7 percent of sales or receipts in the non-manufacturing MP&M sectors.

Table 3.16: Number of Facilities and Sales/Receipts by Facility Employment Size Category: MP&M Non-Manufacturing Sectors										
Sector	Number of Facilities					Sales/Receipts (millions, \$1992)				
	0 to 4	5 to 9	10 to 19	20 to 99	100 or more	0 to 4	5 to 9	10 to 19	20 to 99	100 or more
Aircraft	1,148	552	455	539	152	240	291	494	1,937	3,067
Bus & Truck	45,917	17,414	14,524	15,750	629	11,432	11,385	18,211	90,748	8,006
Household Equipment	2,078	737	387	181	10	381	406	511	670	170
Instruments	5,942	2,037	1,128	806	195	949	993	1,155	2,011	1,377
Motor Vehicle	106,478	44,749	21,773	19,314	1,647	33,379	36,659	53,593	278,225	92,389
Office Machine	7,113	1,691	1,147	974	168	1,579	1,191	1,653	4,084	3,981
Other Metal Products	22,509	6,851	3,239	1,709	3	3,642	3,099	3,316	5,755	30
Precious Metals and Jewelry	1,163	231	46	17	0	138	60	29	34	0
Ships and Boats	3,077	1,313	877	963	270	1,694	1,808	1,928	8,561	12,776
Stationary Industrial Equipment	9,161	5,511	2,644	1,438	94	2,671	3,540	3,747	5,651	2,411
Total	204,586	81,086	46,220	41,691	3,168	56,104	59,432	84,635	397,676	124,208

Source: Department of Commerce, Bureau of the Census, Census of Transportation, Census of Wholesale Trade, Census of Retail Trade, Census of Service Industries, 1992.

b. Firm size

For most of the non-manufacturing SIC codes, SBA defines small businesses according to the firms' total revenue. Therefore, examining a firms employment size is somewhat

meaningless for non-manufacturers. Approximately 438,800 facilities, or 90 percent, are owned by firms employing 99 workers or less.

**Table 3.17: Number of Firms, Facilities, and Estimated Receipts by Firm Employment Size Category, 1996:
MP&M Non-Manufacturing Sectors**

Sector	Firms			Facilities			Estimated Receipts (millions, \$1996)		
	1 to 99	100 to 499	500 or more	1 to 99	100 to 499	500 or more	1 to 99	100 to 499	500 or more
Aircraft	3,124	80	77	3,189	139	734	2,549	1,186	5,695
Bus & Truck	111,038	2,001	801	112,751	4,334	10,590	74,421	22,461	62,021
Household Equipment	3,669	19	18	3,700	23	212	1,906	258	819
Instruments	7,277	76	91	7,536	206	1,443	2,926	527	3,485
Motor Vehicle	209,814	3,010	531	216,707	7,119	10,716	437,146	174,565	81,721
Office Machine	32,428	290	198	32,745	759	1,646	13,872	4,503	9,911
Other Metal Products	35,788	284	218	36,205	567	1,130	15,712	2,165	4,325
Precious Metals and Jewelry	1,615	6	4	1,661	105	72	252	0	0
Ships and Boats	7,833	243	214	8,000	519	743	8,525	5,743	19,225
Stationary Industrial Equipment	14,587	302	186	16,331	1,359	4,101	14,467	4,321	7,260
Total	427,173	6,311	2,338	438,825	15,130	31,387	571,776	215,729	194,463

Source: Small Business Administration, Statistics of U.S. Businesses.

3.5 CHARACTERISTICS OF POTENTIALLY-REGULATED MP&M FACILITIES

The Agency is not using industrial sectors to subcategorize the regulations for the MP&M industry. EPA has determined that the industrial sectors are too broad for the purposes of subcategorization, and many facilities perform operations covered by multiple sectors. Instead, EPA is proposing to define subcategories based on unit operations performed and the nature of the waste generated. EPA has determined that a basis exists for dividing the MP&M

category into the following subcategories for the proposed rule: General Metals, Non-Chromium Anodizing, Metal Finishing Job Shops, Printed Wiring Boards, Steel Forming and Finishing, Oily Wastes, Railroad Line Maintenance, and Shipbuilding Dry Dock.

Table 3.18 shows the national number of MP&M facilities that sell products to different combinations of sectors. The table shows that many MP&M facilities operate in multiple market sectors. There is an overlap for almost every combination of sectors, and some MP&M facilities report revenues from three or more sectors.

Table 3.18: Overlap of Sectors

Sectors	Aerospace	Aircraft	Bus and Truck	Electronic Equipment	Hardware	Household Equipment	Instrument	Mobile Industrial Equipment	Motor Vehicle	Office Machine	Ordnance	Other Metal Products	Precious/Non-Precious Metals	Railroad	Ship and Boat	Stationary Industrial Equip.	Unknown
Aerospace	141																
Aircraft	0	189															
Bus and Truck	117	126	1,191														
Electronic Equipment	129	145	141	225													
Hardware	141	165	153	177	324												
Household Equipment	72	72	84	107	143	500											
Instrument	84	108	93	123	150	153	297										
Mobile Industrial Equipment	24	44	53	47	59	47	56	158									
Motor Vehicle	93	102	122	117	229	186	144	83	518								
Office Machine	84	120	81	100	119	96	120	44	56	156							
Ordnance	12	12	12	12	12	12	12	12	12	12	12						
Other Metal Products	81	102	98	93	204	150	132	102	289	56	12	714					
Precious and Non-Precious Metals	24	36	0	24	36	12	36	12	24	36	0	35	113				
Railroad	0	0	23	12	57	12	12	21	57	12	0	45	0	174			
Ship and Boat	60	0	86	84	96	72	93	41	65	81	0	33	12	22	129		
Stationary Industrial Equipment	24	40	44	63	102	71	82	113	90	52	12	135	12	22	46	216	
Unknown																	12

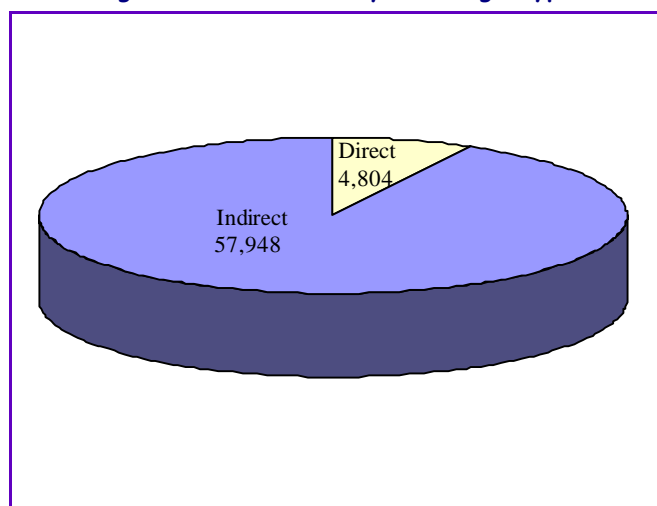
Source: U.S. EPA analysis.

The rest of this profile characterizes MP&M facilities that are expected to incur compliance costs under the proposed effluent guidelines.

Out of a total population of 638,696 MP&M facilities reported in the *Statistics of U.S. Businesses* for 1996, effluent dischargers identified by the MP&M surveys number an estimated 62,752 (10 percent).

Figure 3.2 shows the breakdown of MP&M facilities by discharge type. Of the 62,752 effluent dischargers, 57,948 (92 percent) are indirect dischargers, while the remaining 4,804 (8 percent) are direct dischargers.

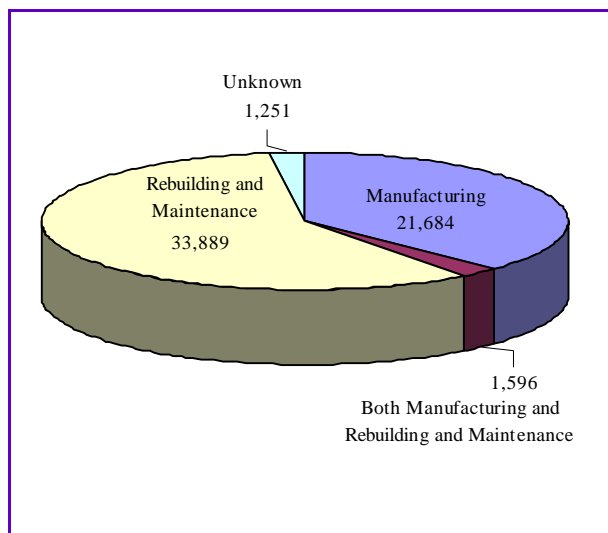
Figure 3.2: Facilities by Discharge Type



Source: U.S. EPA analysis.

Figure 3.3 shows facilities by revenue source, such as manufacturing, rebuilding and maintenance, or government. There are 35,485 facilities (61 percent) that perform rebuilding and maintenance and 23,280 facilities (40 percent) that do manufacturing.

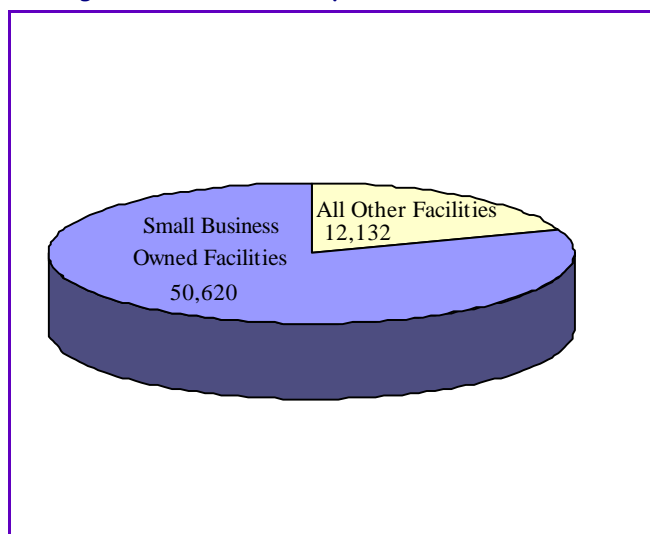
Figure 3.3: Number of Private Facilities by Revenue Source



Source: U.S. EPA analysis.

Small Business Administration (SBA) thresholds for small businesses were applied to each facility to estimate the number of facilities that are likely to be owned by small businesses, as defined by the SBA. By using the methodology detailed in Regulatory Flexibility Analysis (see Chapter 10), EPA determined that 50,620 facilities (81 percent) are owned by small entities.

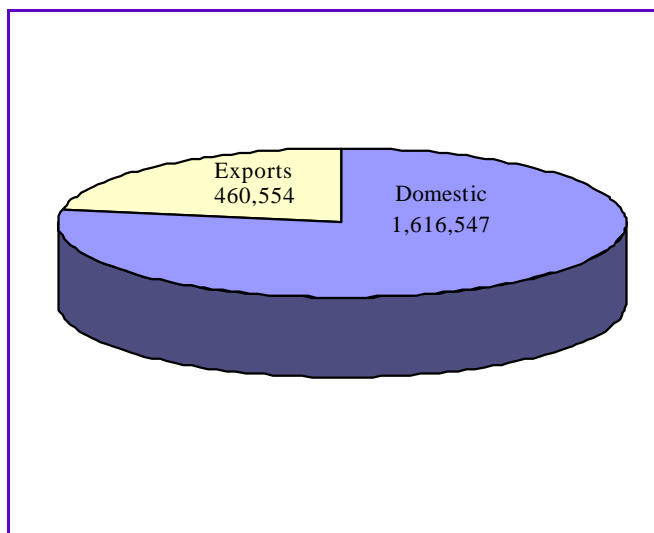
Figure 3.4: Facilities by Small Business Status



Source: U.S. EPA analysis.

Figure 3.5 indicates that MP&M facilities derive approximately 22 percent of their revenues from export sales. Almost 78 percent of MP&M revenues come from domestic non-government sources. Governments account for a very small share of MP&M revenues overall.

Figure 3.5: Facility Revenues by Market Type
(millions, 1999\$)



Export data were not available for Iron and Steel surveys.

Source: U.S. EPA analysis.

The **Pre-Tax Return on Assets (PTRA)** is a useful measure of industry profitability. It is well-defined,

commonly used, and can be calculated from data reported in the facility surveys. Profits compensate investors not only for the use of their capital, but also for the riskiness of their investment. One firm might have a higher PTRA than another but not be more profitable in economic terms, because it is riskier.

Table 3.19 shows that the steel forming and finishing subcategory has the highest median PTRA (15.9 percent) of all the subcategories. The MP&M facilities may not be typical of the Iron and Steel industry as a whole since they produce only selected finished products. The shipbuilding drydock subcategory has the lowest PTRA (2.5 percent).

Table 3.19: Financial Performance	
Subcategory	Median Pre-Tax Return on Assets (PTRA)
Shipbuilding Drydock	2.5%
General Metals	13.5%
Steel Forming & Finishing	15.9%
MF Job Shop	6.8%
Non-Chromium Anodizer	9.0%
Oily Wastes	12.9%
Printed Wiring Boards	14.6%
Railroad Line Maintenance	n/a

Source: U.S. EPA analysis.

GLOSSARY

capital expenditures: expenditures for permanent additions and major alterations to facilities and equipment, as well as replacements and additions to capacity, which are ordinarily depreciated. Reported capital expenditures include work done on contract and expenditures for assets leased from other concerns through capital leases. Expenditures for land and cost of maintenance and repairs charged as current operating expenses are excluded.

employment: total number of full-time equivalent employees, including production workers and non-production workers.

export dependence: the share of shipments by domestic producers that is exported; calculated by dividing the value of exports by the value of domestic shipments.

import penetration: the share of all consumption in the U.S. that is provided by imports; calculated by dividing imports by reported or apparent domestic consumption (the latter calculated as domestic value of shipments minus exports plus imports).

manufacturing: series of unit operations necessary to produce metal products; generally performed in a production environment.

North American Industry Classification System: classification system adopted beginning in 1997 to replace SIC codes. NAICS codes will be used throughout North American and allow for greater comparability with the International Standard Industrial Classification System (ISIC), which is developed and maintained by the United Nations. The new system also better reflects the structure of today's economy, including the growth of the service sectors and new technologies.

nominal values: dollar values expressed in current dollars.

operating margin: measure of the relationship between input costs and the value of production, as an indicator of financial performance and condition. Everything else being equal, industries and firms with lower operating margins will generally have less flexibility to absorb the costs associated with a regulation than those with higher operating margins. Operating margins were calculated in this profile by subtracting the cost of materials and total payroll from the value of shipments. Operating margin is only an approximate measure of profitability, since it does not consider capital costs and other costs. It is used to examine trends in revenues compared with production costs within an industry; it should not be used for cross-industry comparisons of financial performance.

pre-tax return on assets (PTRA): the ratio of cash operating income (net income plus depreciation) to the book value of total assets. This ratio is a measure of facility profitability.

primary product shipments: an establishment's shipments of products that are considered primary to its 4-digit SIC code. An establishment is classified in a particular 4-digit SIC code if its shipments of the primary products of that industry exceed in value its shipments of the products of any other single industry.

producer price index (PPI): a family of indexes that measures the average change over time in selling prices received by domestic producers of goods and services (Bureau of Labor Statistics, PPI Overview). Used in this profile to convert nominal values into real dollar values.

real values: nominal values normalized using a price index to express values in a single year's dollars. Removes the effects of price inflation when evaluating trends in dollar measures.

rebuilding/maintenance: unit operations necessary to disassemble used metal products into components, replace the components or subassemblies or restore them to original function, and reassemble the metal product. These operations are intended to keep metal products in operating condition and can be performed in either a production or a non-production environment.

Standard Industrial Classification: classification system used for all establishment-based Federal economic statistics classified by industry. Each establishment is assigned a 4-digit SIC code based on its principal product, or service. Last revised in 1987 and currently being replaced by the NAICS.

value added: measure of manufacturing activity, derived by subtracting the cost of purchased inputs (materials, supplies, containers, fuel, purchased electricity, contract work, and contract labor) from the value of shipments (products manufactured plus receipts for services rendered), and adjusted by the addition of value added by merchandising operations (i.e., the difference between the sales value and the cost of merchandise sold without further manufacture, processing, or assembly) plus the net change in finished goods and work-in-process between the beginning-and end-of-year inventories. Value added avoids the duplication in value of shipments as a measure of economic activity that results from the use of products of some establishments as materials by others. Value added is considered to be the best value measure available for comparing the relative economic importance of manufacturing among industries and geographic areas.

value of shipments: net selling values of all products shipped as well as miscellaneous receipts. Includes all items

made by or for an establishment from materials owned by it, whether sold, transferred to other plants of the same company, or shipped on consignment. Value of shipments is a measure of the dollar value of production, and is often used

as a proxy for revenues. This profile uses value of shipments to indicate the size of a market and how the size differs from year to year, and to calculate operating margins.

ACRONYMS

SIC: Standard Industrial Classification

NAICS: North American Industry Classification System

VOS: value of shipments

VA: value added

PPI: producer price index

PTRA: pre-tax return on assets

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